

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2017/2018

### PMT0101 – MATHEMATICS I

(Foundation in Information Technology)

11 OCTOBER 2017

9:00 a.m. – 11:00 a.m.

(2 Hours)

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#### INSTRUCTIONS TO STUDENT

1. This question paper consists of 6 pages with **FIVE** questions.
2. Attempt **ALL** five questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. **Show all relevant steps** to obtain maximum marks.
4. **No calculators are allowed.**

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**You are required to write proper steps.**

**Question 1 [10 marks]**

- a) Simplify the expression and write your final expression as a fraction with positive exponents.

$$\frac{\left(16x^2y^{-\frac{1}{3}}\right)^{\frac{3}{4}}}{\left(xy^{\frac{3}{2}}\right)^{\frac{1}{2}}} \quad (2 \text{ marks})$$

- b) Rationalize the denominator for  $\frac{1+\sqrt{5}}{\sqrt{5}-1}$  and simplify. (2 marks)

- c) Simplify the following expression and give your final expression as a single term.

$$5x\sqrt{\frac{3y^2}{2}} - 3y\sqrt{\frac{27x^2}{2}} + 2\sqrt{\frac{3x^2y^2}{2}}, \quad x \geq 0, y \geq 0 \quad (2 \text{ marks})$$

- d) Factorize the following polynomial completely.

$$3(x^2 + 10x + 25) - (4x + 20) \quad (2 \text{ marks})$$

- e) Simplify the expression below and write your final answer in standard form  $a+bi$ , where  $a$  and  $b$  are real numbers.

$$i^7 + 4i^3 - 2i^2 + 1 \quad (2 \text{ marks})$$

**Continued ...**

**Question 2 (10 marks)**

- a) Find the values of  $k$  such that the quadratic equation  $kx^2 + x + 4 = 0$  has no real solution. (2 marks)

- b) Solve the equation:  $x^4 = 4x^2$ . (2 marks)

- c) Solve the equation:  $\frac{3}{4}|x+1| = 9$ . (1.5 marks)

- d) i) Find the domain of the expression  $\frac{(x-2)(x+1)}{x+3}$ .

Write your domain in interval notation.

- ii) Solve the inequality  $\frac{(x-2)(x+1)}{x+3} \leq 0$ .

Show clearly your Sign Diagram and give your final answer in interval notation.

- iii) Hence, find the domain of  $h(x) = \sqrt{\frac{(x-2)(x+1)}{x+3}}$ .

Give your final answer in interval notation.

(4.5 marks)

**Continued ...**

**Question 3 (10 marks)**

a) Given  $f(x) = \sqrt{x}$  and  $g(x) = 3x - 5$ , find

i) the domains of  $f$  and  $g$ .  
Write your answer in interval notation.

ii)  $(f \circ g)(x)$  and the domain of  $(f \circ g)$ .

iii)  $g^{-1}(x)$ .

(3.5 marks)

b) Given a piecewise-defined function :

$$f(x) = \begin{cases} 3x & \text{if } -2 < x \leq 1 \\ x+1 & \text{if } x > 1 \end{cases}$$

i) Find the domain of  $f$ . Write your answer in interval notation.

ii) Find  $f(5)$  and  $f(0)$ .

(1.5 marks)

c) Given the polynomial function  $f(x) = -(x-4)(x+3)^2(x-1)^3$ .

i) What is the degree of  $f$ ?

ii) Determine the zeros of  $f$  and their multiplicities.

Also, determine whether the graph of  $f$  crosses or touches the  $x$ -axis at each zero.

iii) Determine its  $y$ -intercept.

iv) Determine the end behavior of  $f$ .

v) Sketch the graph of the polynomial function.

Make sure your graph shows all intercepts and exhibits the proper end behaviour.

(5 marks)

**Continued ...**

**Question 4 (10 marks)**

- a) Use the Factor Theorem to determine whether  $(x+3)$  is a factor of  $f(x) = 2x^3 - x^2 + 2x - 3$ .

(1.5 marks)

- b) Given  $\log_a 3 = m$  and  $\log_a 2 = n$ , express  $\log_a 12$  in terms of  $m$  and  $n$ .

(1.5 marks)

- c) The graph of  $g(x) = 3\log_2(x-1)$  passes through point  $(k, 9)$ .

- i) Determine the value of  $k$ .  
ii) Find the  $x$ -intercept of the graph.

(3 marks)

- d) Solve the following equations:

i)  $5^{2x+3} = \frac{1}{125}$

ii)  $7^{x+3} = e^x$   
Leave your final answer in terms of natural logarithms.

(4 marks)

**Continued...**

**Question 5 (10 marks)**

- a) The equations of two lines are  $3x + ky + 2 = 0$  and  $4x + y - 1 = 0$ .  
Find the value of  $k$  if the lines are

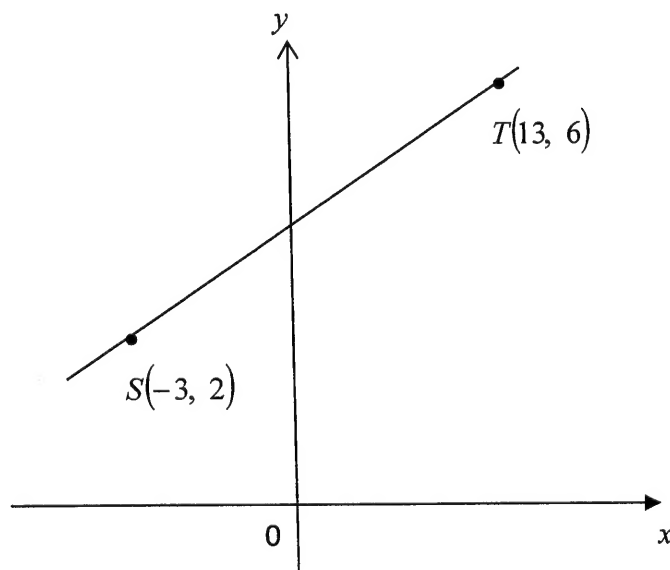
i) parallel

ii) perpendicular (2 marks)

- b) By completing the square method, transform the equation of a circle  $x^2 + y^2 + 8x - 10y + 16 = 0$  to the form  $(x - h)^2 + (y - k)^2 = r^2$  where  $h$ ,  $k$  and  $r$  are constants.

Hence, find the center and radius of the circle. (3 marks)

- c) The diagram below shows part of a straight line which passes through points  $S(-3, 2)$  and  $T(13, 6)$ .

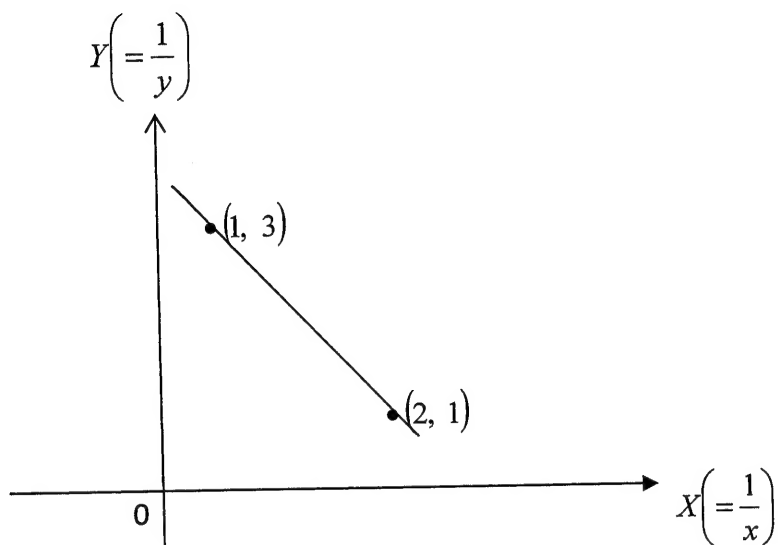


Find an equation of the locus of a moving point  $P(x, y)$  which is always equidistant from points  $S(-3, 2)$  and  $T(13, 6)$ .

(3 marks)

**Continued...**

- d) The diagram below shows part of a straight line obtained by plotting  $Y\left(=\frac{1}{y}\right)$  against  $X\left(=\frac{1}{x}\right)$ .



Express  $y$  in terms of  $x$ .

(2 marks)

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